CLAIMS

WHAT IS CLAIMED IS:

1. An electrical power interface for energizing at least one electrodeionization (EDI)module from an alternating current (AC) source, the at least one EDI module purifying a fluid flow when DC power is provided between an anode and a cathode of the at least one EDI module, said electrical power interface converting the power from the AC source into stable DC power that is unaffected by the fluid temperature, fluid flow rate, fluid quality, or variances in the AC source or in the construction of the at least EDI module.

2. The electrical power interface of Claim 1 comprising:

a transformer, coupled to the AC source, that can be adjusted for providing varying AC power at said transformer output;

a phase-controller for controlling the operation of a rectifier based on the AC power and on a feedback signal from the DC power.

3. The electrical power interface of Claim 2 wherein said transformer is an autotransformer.

4. The electrical power interface of Claim 3 further comprising an automatic control system coupled to said autotransformer for automatically adjusting said autotransformer.

5. The electrical power interface of Claim 4 wherein said automatic control system comprises:

a sampling circuit having an input coupled to said anode;

a reference voltage circuit having an input coupled to an output of said sampling circuit to form an electrical power interface input, said reference voltage circuit comparing said electrical power interface input against a reference voltage to generate difference signal;

an amplifier for amplifying said difference signal;

a DC motor having an electrical power input coupled to a DC power supply through a switch controlled by said amplifier, said DC motor having a mechanical output coupled to and controlling a spindle of said autotransformer based on said difference signal.

7. The electrical power interface of Claim 2 wherein said feedback signal comprises a voltage signal.

8. The electrical power interface of Claim 2 wherein said rectifier is a full-wave rectifier.

9. The electrical power interface of Claim 2 wherein said rectifier comprises a single-phase rectifier.

10. The electrical power interface of Claim 2 wherein said rectifier comprises a three-phase rectifier

11. The electrical power interface of Claim 3 wherein said at least one EDI module comprises alternating anionic and cationic membranes which define alternating fluid chambers and concentrate chambers for conveying said fluid flow and a concentrate flow, respectively, said fluid chambers comprising ion exchange resins, all of which are spirally-wound around a central conductive pipe and all of which are contained within a conductive lining, said central conductive pipe comprising said cathode and said conductive lining comprising said anode.

12. The electrical power interface of Claim 11 further comprising an automatic control system coupled to said autotransformer for automatically adjusting said autotransformer.

13. The electrical power interface of Claim 12 wherein said automatic control system comprises:

a sampling circuit having an input coupled to said anode;

a reference voltage circuit having an input coupled to an output of said sampling circuit to form an electrical power interface input, said reference voltage circuit comparing said electrical power

interface input against a reference voltage to generate difference signal;

an amplifier for amplifying said difference signal;

a DC motor having an electrical power input coupled to a DC power supply through a switch controlled by said amplifier, said DC motor having a mechanical output coupled to and controlling a spindle of said autotransformer based on said difference signal.

14. The electrical power interface of Claim 11 wherein said feedback signal comprises a voltage signal.

15. The electrical power interface of Claim 11 wherein said rectifier is a full-wave rectifier.

16. The electrical power interface of Claim 11 wherein said rectifier comprises a single-phase rectifier.

17. The electrical power interface of Claim 11 wherein said rectifier comprises a three-phase rectifier.

18. A method for providing a stable DC current to at least one electrodeionization (EDI) module from an alternating current (AC) source wherein the at least one EDI module purifies a fluid flow when DC power is provided between an anode and a cathode of the at least one EDI module, said method comprising the step of rectifying the AC power from the AC source into DC power using phase control and DC power feedback to stabilize the DC current after rectification that is unaffected by the fluid temperature, fluid flow rate, fluid quality, or variances in the AC source or in the construction of the at least one EDI module.

19. The method of Claim 18 wherein step of rectifying the AC power comprises synchronizing a phase controller with the AC power.

20. The method Claim 19 wherein said step of rectifying the AC power comprises feeding back a voltage signal from the DC power to said phase controller.

21. The method of Claim 18 wherein said phase controller uses proportional/integral control to generate pulse commands to a rectifier.

22. The method of Claim 21 wherein said step of using proportional/integral control permits the control of pulse command parameters.

23. The method of Claim 22 wherein said pulse command parameters include pulse width.

24. The method of Claim 22 wherein said pulse command parameters include pulse amplitude.

25. The method of Claim 22 wherein said pulse command parameters include pulse edge slope.

26. The method of Claim 21 wherein step of rectifying the AC power into DC power comprises disposing an autotransformer between the AC source and a rectifier, said autotransformer being adjustable.

27. The method of Claim 26 wherein said step of disposing an autotransformer between the AC source and said rectifier comprises automatically controlling the adjustment of said autotransformer based on said DC current.

28. The method of Claim 27 wherein said step of automatically controlling the adjustment of said autotransformer comprises:

coupling a DC motor output to said autotransformer;

continuously comparing a portion of said DC power to a reference and using a difference between said portion of said DC power and said reference to activate said DC motor.

29. An electrical power interface for energizing at least two electrodeionization (EDI)modules connected in electrical series from an alternating current (AC) source, the at least two EDI modules purifying a fluid flow when DC power is provided between an anode of one of said at least two EDI modules and a cathode of the other one of said at least two EDI modules, said electrical power interface comprising a rectifier for converting

the power from the AC source into DC power, said rectifier powering said at least two modules with the same DC current.

30. The electrical power interface of Claim 29 wherein said rectifier is controlled to convert the power from the AC source into stable DC power that is unaffected by the fluid temperature, fluid flow rate, fluid quality, or variances in the AC source or in the construction of the at least two EDI modules.

31. The electrical power interface of Claim 30 comprising:

a transformer, coupled to the AC source, that can be adjusted for providing varying AC power at said transformer output;

a phase-controller for controlling the operation of said rectifier based on the AC power and on a feedback signal from the DC power, said rectifier having a positive node and a negative node; and

wherein said positive node is coupled to the anode of said one of said at least two EDI modules and wherein said negative node is coupled to the cathode of said other one of said at least two EDI modules, and wherein the cathode of said one of said at least two EDI modules is coupled to the anode of said other one of said at least two EDI modules.

32. A method for providing a DC current to at least two electrodeionization (EDI) modules, connected in electrical series, from an alternating current (AC) source wherein the at least two EDI modules purify a fluid flow when DC power is provided between an anode of one of said at least two EDI modules and a cathode of the other one of said at least two EDI modules, said method comprising the step of rectifying the AC power from the AC source into DC power and powering said at least two EDI modules with the same DC current.

33. The method of Claim 32 wherein said step of rectifying the AC power comprises using phase control and DC power feedback to stabilize the DC current after rectification that is unaffected by the fluid temperature, fluid flow rate, fluid

quality, or variances in the AC source or in the construction of the at least EDI module.

34. The method of Claim 33 wherein step of rectifying the AC power comprises synchronizing a phase controller with the AC power.

35. The method Claim 34 wherein said step of rectifying the AC power comprises feeding back a voltage signal from the DC power to said phase controller.

36. The method of Claim 33 wherein said phase controller uses proportional/integral control to generate pulse commands to a rectifier.

37. The method of Claim 36 wherein said step of using proportional/integral control permits the control of pulse command parameters.